

## GEOLOGIC AND GEOMORPHIC FEATURES RELATED TO LANDSLIDING MATTOLE RIVER WATERSHED, HUMBOLDT AND MENDOCINO COUNTIES, CALIFORNIA PLATE 1, SHEET 3 OF 3 (SOUTHERN PORTION)

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### MAP UNITS

#### QUATERNARY AND LATE TERTIARY OVERLAP DEPOSITS

Qm	Un differentiated Brown Channel Deposits (Holocene) - Unconsolidated sediments in active channels and flood plains.
Qs	Beach Sand (Holocene) - Marine-laid deposits of fine to coarse-grained sand and gravel; may migrate seasonally.
Qd	Alluvial Deposits (Holocene) - Unconsolidated fine- to medium-grained, well-sorted sand.
Qf	Alluvial fan (Holocene) - Conical-to-fan-shaped deposits at the mouth of eroding stream channels; includes debris fans.
Qa	Alluvium (Holocene and Late Pleistocene) - Unconsolidated alluvial deposits of unconsolidated sand, gravel, silt, and silt and clay.
Qc	Colluvium (Holocene-Pleistocene) - Talus and rock wash deposits.
Qol	Old alluvium (Early Holocene and Pleistocene) - Unconsolidated to weakly consolidated alluvial deposits above the active channel in broader canyons and valleys; vegetation is characteristically well-established.
Qrt	Row terrace deposits (Holocene and Pleistocene) - Sand and gravel deposited in a shallow marine setting on gently inclined, seaward-facing, low-lying terrace stands over flat-lying to gently inclined platforms.
Qm	Marine terrace deposits (Quaternary) - Sand and gravel deposited in a shallow marine setting on gently inclined, seaward-facing, low-lying terrace stands over flat-lying to gently inclined platforms.
Qa	Un differentiated terrace deposits (Quaternary) - Alluvial and/or (near) the coast shallow marine deposits preserved in erosional remnants of older platforms well above present stream level.
Qta	Overlap Deposits (Neogene) - Wildcat Group-equivalent rocks; weakly tilted sandstone, mudstone, and minor conglomerate.

#### FRANCISCAN COMPLEX\*

U01	Melange - Dominantly highly folded argillite and highly clayey, pervasively sheared rock that exhibits rounded, lumpy, and irregular, poorly sorted topography.
U02	Melange - Subequal amounts of unaltered sandstone and argillite with much clayey, pervasively sheared rock that exhibits generally irregular topography locally well-sorted sandstone.
U03	Broken sandstone and argillite - Exhibits sharp-crested topography with a well-sorted system of saddle drainage.
U04	Intact sandstone and argillite - Exhibits sharp-crested topography with a regular, well-sorted system of saddle drainage.
U05	Basaltic rocks (Late Cretaceous) - Pillow flow, tuff, flow breccias, and intrative present as rare blocks in melange.
U06	Limestone (Late Cretaceous) - Pink to red, magnesian, and containing pelagic faunal remains.
U07	Basaltic (Jurassic)

K01	Igneous and sedimentary rocks of Post-Deltaic (Late Cretaceous) - Basaltic rocks, sandstone, minor argillite, and melange containing rare basaltic blocks.
K02	Melange and (or) folded argillite of King Peak - Thin-bedded, tightly folded, predominantly argillite sequences that exhibit saddle, irregular topography, and a well-sorted system of saddle drainage.
K03	Highly folded, broken formation of King Peak - Thin to thick-bedded argillite sandstone and calcareous argillite that exhibit sharp-crested topography with well-sorted but irregular saddle drainage.
K04	Highly folded, largely unbroken rocks of King Peak - Sandstone and argillite that exhibit sharp-crested topography with a regular, well-sorted system of saddle drainage.
K05	Limestone - Red to white, locally with plastic or benthic tabularities; present locally as melange blocks, and as irregular, well-sorted argillite.
K06	Chert - Red to green, locally magnesian, with radiolaria and diatoms.
K07	Basaltic rocks - Tholeiitic and alkalic; present as rare blocks in melange.
K08	Yager Terrane (Eocene to Paleocene) - Sheared and highly folded mudstone - Includes minor rhythmically interbedded sandstone, locally with lenses of conglomerate. Exhibits irregular topography, including a well-sorted system of saddle drainage.
K09	Highly folded, broken mudstone, sandstone, and conglomeratic sandstone - Exhibits topography with sharp ridges and well-sorted saddle drainage.
K10	Highly folded, little-broken sandstone, conglomerate, and mudstone - Exhibits sharp-crested topography with a regular, well-sorted system of saddle drainage.
K11	Conglomerate - Polymict, well-sorted clasts that include volcanic, granitic, and late common metamorphic rocks.
K12	Central Belt (Paleocene to Jurassic) - Melange - Predominantly pervasively sheared, locally tuffaceous, scaly meta-argillite and less abundant blocks of metamorphic.
K13	Broken formation - Bedded to massive, locally folded, rarely conglomeratic metamorphic and meta-argillite, with minor highly sheared sand.
K14	White Rock metamudstone (Paleocene and/or Late Cretaceous) - Argillite sandstone and minor meta-argillite, thin-bedded to massive, unaltered and sheared.
K15	Limestone (Late to Early Cretaceous) - Red, pink, gray, or white fossiliferous limestone.
K16	Basaltic rocks (Cretaceous and Jurassic) - Includes pillow and non-pillow flows, flow breccias, submarine tuff, and diatom.
K17	Melange block - Lithology unknown.
K18	Serpentinite - Interbedded locally along faults.

\* Franciscan Complex subdivisions from McLaughlin and others, 2000.

### MAP SYMBOLS

---	Lithologic contact: Solid where location is certain, dashed where approximately located or inferred, dotted where concealed, and queried where continuation or existence is uncertain.
---	Fault: Solid where location is certain, dashed where approximately located or inferred, dotted where concealed, and queried where continuation or existence is uncertain.
---	Thrust fault: Barbs on upper plate. Solid where location is certain, dashed where approximately located or inferred, dotted where concealed, and queried where continuation or existence is uncertain.
---	Lineament: Linear features of unknown origin noted on aerial photographs.
---	Anticline: Solid where location is certain, dashed where approximately located or inferred, dotted where concealed, and queried where continuation or existence is uncertain.
---	Syncline: Solid where location is certain, dashed where approximately located or inferred, dotted where concealed, and queried where continuation or existence is uncertain.
---	Strike and dip of bedding: Strike and dip of bedding, top indicator observed.
---	Strike and dip of overturned bedding: Strike and dip of overturned bedding, top indicator observed.
---	Strike of vertical bedding: Strike of vertical bedding, top indicator observed.
---	Strike and dip of station: Strike and dip of station, top indicator observed.
---	Strike and dip of joint: Strike and dip of joint, top indicator observed.

---	ROCK SLIDE (ROTATIONAL) / TRANSLATIONAL LANDSLIDE: Slope movement with bedrock as its primary source material. The class of failure includes rotational and translational landslides; relatively cohesive slide masses with failure planes that are close-sited in comparison to those debris slides of similar areal extent. The slide plane is curved in rotational slides. Movement along a planar joint or bedding surface may be referred to as translational. Complex versions with combinations of rotational movement and translational movement are common. "T" indicates a scar; arrows show direction of movement; queried where the presence of the slide is uncertain. Boundary is solid where historically active, dashed where dormant, and queried where uncertain.
---	EARTHFLOW: Slow to rapid movement of mostly fine-grained soil with some rocky debris in a semi-viscous, highly plastic state. After initial failure, the mass may flow or creep seasonally in response to changes in groundwater level. These types of slide features often include continuous or well-defined rotational slides and debris ridges. Boundaries are usually indistinct. "A" indicates a scar; arrows show direction of movement; queried where the presence of the slide is uncertain. Boundary is solid where historically active, dashed where dormant, and queried where uncertain.
---	DEBRIS SLIDE: Mass of unconsolidated rock, column, and coarse-grained soil that has moved slowly to rapidly downslope along a relatively steep, shallow, translational failure plane. Debris slides form steep, unvegetated scars in the head region and possibly irregular, hummocky deposits in the toe region. Scars commonly seal and remain unvegetated for several seasons depending on slope aspect. Queried where the presence of the slide is uncertain. Boundary is solid where historically active, dashed where dormant, and queried where uncertain.
---	DEBRIS FLOW / TORRENT TRACK: Long stretches of bare ground that have been scoured and eroded to bedrock by extremely rapid movement of water-laden debris. Debris flows are commonly triggered by debris sliding in the source area during high intensity rains. Debris is often deposited downslope as a tangled mass of organic material in a matrix of rock and soil. Debris may be renewed and incorporated into subsequent events; lack of vegetation indicates recent activity. Queried where the presence of the slide is uncertain. Boundary is solid where historically active, dashed where dormant, and queried where uncertain.
---	SMALL LANDSLIDE: Landslide too small to delineate at 1:24,000 scale (typically less than 1/5 acre in area or less than 100 feet in length).
---	DISRUPTED GROUND: Irregular ground surface caused by complex landsliding processes resulting in features that are indistinguishable or too small to delineate individually at 1:24,000 scale; also may include areas affected by downslope creep, expansive soils, and/or gully erosion. Boundaries are usually indistinct.
---	DEBRIS SLIDE SLOPE / SOURCE AREA: A geomorphic feature characterized by steep, usually well vegetated slopes that appear to have been scoured by numerous debris slides and debris flows. Upper reaches (source areas) of these slopes are often lightly concave and very steep. Soil and colluvium also bedrock may be described by active debris slides and debris flows. Slopes near the angle of repose may be relatively stable except where weak bedding planes, bedrock joints and features parallel the slope.
---	INNER GORGE: A geomorphic feature consisting of steep slopes adjacent to channels. The gorge typically is created by accelerated downcutting in response to regional uplift. It is defined as an area of incision between the channel and the first break in slope. Line is queried where uncertain, or broken into segments to represent a stretch of discontinuous inner gorge too small to accurately represent at 1:24,000 scale. One-sided hachures indicate inner gorge on one side of channel only; hachures point downslope.
---	GULLY: Distinct, narrow channel formed by erosion of soil or soft rock material by running water. Channels are larger and deeper than rills and usually carry water only during and immediately after heavy rain or following the melting of ice or snow. Arrows point downhill; line is queried where uncertain.

### GEOLOGICAL NOTES

- The landslides and geomorphic features were mapped from 1984 WAC aerial photographs, nominal scale 1:50,000, and 2000 WAC aerial photographs, nominal scale 1:24,000. Field verification of landslide and geomorphic features was very limited and mapping relied primarily on interpretation of aerial photographs.
- The geology depicted on this map was modified from 1:100,000 scale source data (McLaughlin and others, 2000). Although the geology has been presented on this map at a scale of 1:24,000, the detail and accuracy of the bedrock and structural data are limited to the spatial resolution of the 1:100,000 scale in which the digital database was originally compiled.
- Please see geologic report for full lithologic descriptions, geologic settings, methodologies and limitations.
- Landslides shown on this map have been divided into groups based on the clarity of their morphology and inferred types of movement. The landslides are also classified according to the certainty of their existence as determined by analysis of aerial photographs. The various landslide designations are not intended to, nor should they be interpreted to imply, the relative stability of slopes involved. Please see Plate 2 for relative landslide potential of the study area.
- The scale of this map limits the definition of some features, and the map should not be substituted for site-specific studies.
- Information on this map is not sufficient to serve as a substitute for the geologic and geotechnical site investigations required under Chapters 7.5 and 7.6 of Division 2 of the California Public Resources Code.
- Historical mapping by CEG (Spittler, 1983 and 1984; DMG, 1986) was considered and incorporated using current interpretive protocols for identifying and classifying geomorphic features and/or landslides. Historical mapping added directly to the Mattole River Watershed database is referenced in the electronic database with a citation to the North Coast Watershed Mapping, digital compilation DMG CD 99-002 (DMG, 1999).
- All small landslides depicted on the map as points inferred from review of the 1984 and 2000 aerial photograph sets and those mapped on CEG Open-File Reports (Spittler, 1983 and 1984) are shown on the map.
- Digital data shown on this map as well as additional landslide and fluvial geomorphology data are available from the following sources on the CEG website at [www.conservancy.org/govinfo](http://www.conservancy.org/govinfo), on compact disc from CEG CD-ROM 2002-01, or on the North Coast Watershed Assessment Program website at [www.northcoastwatershed.ca.gov](http://www.northcoastwatershed.ca.gov).

### REFERENCES

- California Division of Mines and Geology, 1989. North Coast Watershed mapping, digital compilation DMG CD 99-002, California Department of Conservation, Division of Mines and Geology.
- McLaughlin, R.J., Ellen, S.D., Blake, M.C., Jr., Janko, A.S., Irwin, W.P., Aalto, K.R., Carver, G.A., and Clark, S.J., Jr., 2000. Geology of the Cape Mendocino, Eureka, California and offshore areas, northern California, U.S. Geological Survey, Miscellaneous Field Studies MF-335, scale 1:100,000, 25 p. with digital data.
- Spittler, T.E., 1984. Geology and geomorphic features related to landsliding, Bransford, Butte County, California. Division of Mines and Geology Open-File Reports 84-10, 84-37, 84-34, 84-11, and 84-36, respectively, scale 1:24,000.
- Spittler, T.E., 1983. Geology and geomorphic features related to landsliding, Bull Creek and West 7.5 quadrangles, Humboldt County, California. California Division of Mines and Geology, Open-File Reports 83-3 and 83-6, respectively, scale 1:24,000.

### MATTOLE AERIAL PHOTOGRAPHS BY YEAR

- WAC Corporation, Inc., 2000. Flight WAC-00-CA; roll 4, frames 1-15, 83-96, 164-167 and 173-175; roll 6, frames 1-12 and 85-112; roll 7, frames 1-15, 48-63, 88-107, 125-148, 165-177, 191-201 and 213-219; roll 9, frames 175-191; black and white, vertical, nominal scale 1:24,000, dated 3-31-00.
- WAC Corporation, Inc., 2000. Flight WAC-00-CA; roll 10, frames 64-67, 70-75 and 77-81; black and white, vertical, nominal scale 1:24,000, dated 3-31-00.
- WAC Corporation, Inc., 1986. Flight WAC-86-CA; roll 21, frames 42-54, 95-109, 131-142, 161-169, 185-193 and 203-217; roll 24, frames 66-78 and 160-171; roll 25, frames 75-85; black and white, vertical, nominal scale 1:21,000, dated 5-6-84.

North American Datum of 1983 (NAD83)  
Projection: Universal Transverse Mercator, Zone 10

### DATA SOURCES

Watershed boundaries	1:24,000 California Watershed Map (CALWATER v.2.2a)
Topography	1:24,000 USGS 3-D
Transportation	1:24,000 USGS 2-D
Hydrography	1:24,000 USGS 2-D
Public Land Survey System	1:100,000 USGS 2-D
County boundaries	1:100,000 USGS 2-D



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